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April 11, 2011

VIA ELECTRONIC DELIVERY

Marlene H. Dortch, Secretary
Federal Communications Commission
Office of the Secretary
445 12th Street, SW
Washington, DC 20554

Re: PS Docket 06-229, et al.
FCC 11-6: THIRD REPORT AND ORDER
AND FOURTH FURTHER NOTICE OF PROPOSED RULEMAKING
Specifically: Implementing a Nationwide, Broadband, Interoperable Public
Safety Network in the 700 MHz Band
And Specifically: Service Rules for the 698-746, 747-762 and 777-792 MHz Bands

In accordance with the Commission's rules, the state of Minnesota, acting through its Division of Emergency Communication Networks, submits this filing regarding the above-captioned proceeding and the Commission's request for comment therein.

The Commission is taking the right steps to ensure nationwide interoperability over the nationwide public safety wireless broadband data network. Much of the proposed framework will help to foster the highest possible level of interoperability on the network.

However, it is not appropriate for the Commission to determine specific technical requirements for regional networks. Such requirements should be tailored to the user.

Finally, the Commission should work to the fullest extent possible to ensure that public safety organizations can explore various partnerships, such as have been proposed by the Commission. These partnerships may not only justify the cost of building such networks, but may be the only vehicle through which they can be fully funded, and are, in the State's opinion, to the benefit of the general public good.

Respectfully,

A handwritten signature in black ink that reads "Jackie Mines".

Jackie Mines, Director

Minnesota Emergency Communication Networks

The following is written on behalf of the state of Minnesota (“the State”), acting through its Department of Public Safety, Division of Emergency Communication Networks, in reply to statements and inquiries put forth by the United States Federal Communications Commission (“the Commission”) in publication number FCC 11-6.

In summary:

National leadership and nationwide standards are essential for the success of the PSWBN.¹ The Commission, with its proposed framework, is making a good faith effort to ensure that a national governance model and associated standards are pre-established so that the public safety community may use them as a guide as they prepare to implement regional networks, rather than after they are built.

However, it is not the Commission’s place to set requirements for network coverage, in-building penetration, and other technical metrics. Not all users have the same needs, and without the flexibility to approach network design in a targeted, calculated manner, network operators will not be able to implement regional networks to fit specific user needs. A blanket policy that applies to all geographies, economic areas, government entities, and user groups may be too stringent for some and not stringent enough for others.

Frequency coordination between jurisdictions will be essential for the orderly implementation of the PSWBN. The Commission uses local coordination for many other wireless services, and the same approach will benefit the PSWBN. The Commission may consider utilizing the RPCs to perform this coordination, or may also consider some new entity with a similar structure and function.

The Commission must continue to support the public/private partnerships to the fullest extent that it can under law. Such partnerships may be the only means through which to justify and control the expense of building the PSWBN.

Commission (¶ 16): We seek comment on the definition of “interoperability” for purposes of the public safety broadband network in the 700 MHz band . . . We also seek comment on whether this definition should apply only to broadband communications, or should be extended to cover narrowband communications as well.

The State supports the Commission’s goal to harmonize the working definition of “interoperability”.² The State feels that the public safety community should establish a single definition of “interoperability”, and the Commission’s proposal is a step towards that end.

The State disagrees with SAFECOM’s definition, as public safety interoperability should not end at a Radio Access Network (RAN). In fact, as devices on a RAN behave more like devices on a terrestrial Local Area Network (LAN) or Wide Area Network (WAN), it may be inappropriate to associate the term “interoperability” specifically with wireless networks in general. The Commission may consider adopting the state of Minnesota’s own definition:

¹ “Public Safety Wireless Broadband Network”.

² See SAFECOM program of the United States Department of Homeland Security, <http://www.safecomprogram.gov/SAFECOM/interoperability/default.htm>. The SAFECOM program offers the following definition: “The ability of public safety agencies to talk to one another via radio communications systems – to exchange voice and/or data with one another on demand, in real time, when needed and when authorized.”

Interoperability is the ability to communicate, as needed, on demand, and as authorized at all levels of government and across all Public Safety disciplines.

It stands to note that the Commission's current definition of "interoperability" suggests that interoperability is a technology matter. This suggestion does great disservice to the many people who work tirelessly to implement standardized operating procedures and incident communications plans that facilitate general interoperability. Meanwhile, the Department of Homeland Security (DHS) definition properly suggests that interoperability is both a technology and policy matter, but limits the definition to public safety agencies and to radio communications systems where interoperability should include many technology types and government functions.

Commission (¶ 29): Should we adopt rules to ensure that public safety agencies upgrade their networks to incorporate newer releases of LTE on a timely basis?

No, there should be no such requirement. LTE Releases 9 and 10 will be backwards-compatible with prior releases.³ Given that fact, there should be no appreciable impact to general interoperability between regional networks using different releases of LTE. If such an impact emerges, the Commission should revisit this requirement, but at this time, available evidence does not support mandated LTE release upgrades. One such example of backwards-compatibility is that Release 9 networks using carrier aggregation technology to aggregate spectrum into non-contiguous ultra-wide channels will present their carrier components to a Release 8 device as individual single carriers.⁴

It is further noted that the Commission plans to require of network operators full backward compatibility between LTE Release 8 and all future releases.⁵ By the Commission's own admission, this requirement is intended to ensure a "technical baseline for interoperability".⁶

Commission (¶ 29): How do we ensure that all communications available over any network (i.e., voice and data) are available across the nation?

The PSWBN must have standardized multimedia codecs. Where codecs for two devices are incompatible, communications can be translated through a gateway, but users have no benefit of a server-side gateway during peer-to-peer communications. There are gateway products available to land mobile radio network operators to connect disparate networks together,⁷ but they are server-side gateways.

All applications, devices, and network elements in PSWBN should provide interfaces such as APIs. If all parts of the network provide interfaces, manufacturers and application developers can efficiently and effectively implement new solutions. The inability to retrieve basic data and query network elements should not be a

³ See "4G Mobile Broadband Evolution: 3GPP Release 10 and Beyond", February 2011. "LTE-Advanced will provide for backward compatibility with LTE and will meet or exceed all IMT-Advanced requirements . . ."

⁴ See "LTE Rel-9 and LTE-Advanced in 3GPP", presentation slides by Takehiro Nakamura, NTT Docomo (2009).

⁵ See FCC 11-6, ¶ 11: "We will require that any releases after Release 8 ensure backward compatibility between all subsequent releases from Release 8 and onwards. By imposing this requirement on the network operator, we will ensure that the technical baseline for interoperability is preserved."

⁶ See *Id.*

⁷ See, For Example, CISCO Land Mobile Radio Gateway:

http://www.cisco.com/en/US/prod/collateral/routers/ps259/product_data_sheet0900aecd8034ef85_ps5854_Products_Data_Sheet.html. This citation does not imply product endorsement.

barrier to the function of the PSWBN. This requirement is distinct from LTE interfaces provided by the Commission, in that LTE interfaces allow interconnection of the basic network, while APIs provide interconnection between different applications, devices, and network elements.

So long as Commission engages the vendor and user communities in defining standard required LTE interfaces, and required interfaces are chosen by careful deliberation and through the consensus of the larger public safety community, the State supports that specific LTE interfaces are required of network operators. The State has no comment on the list of interfaces presently offered by the Commission.

Commission (¶ 29): Is it necessary to mandate that as voice communications are supported [by LTE], networks must be upgraded within an appropriate time frame? If voice is not required, what does this do for nationwide interoperability across the network? What are the costs of such an approach and do the benefits from having a truly interoperable network outweigh these costs?

No, the requirement is not necessary, and in fact, it is discouraged. As stated above, future releases of LTE are backwards-compatible and gateway devices can insure voice interoperability between disparate networks. Gateways that patch audio between completely different networks have been used by public safety organizations for years, and there is no reason to believe that such devices will not have a place in future networks. Local operators should have the flexibility to determine whether to support voice traffic and whether a gateway device or a system upgrade is the best solution to meet their needs.

The Commission must be sensitive to incumbent land-mobile radio systems. The prevailing view in the public safety community is that early broadband systems will live side-by-side with narrowband systems. It would be onerous and unnecessary to require that public safety broadband systems are upgraded to support voice in cases where public safety organizations would receive no immediate or appreciable benefit from the feature.

Commission (¶ 30): We also recognize that LTE currently allows the use of both IP version 4 (IPv4) and version 6 (IPv6). Would the use of both versions in various components of the nationwide network create obstacles to achieving interoperability, either now or in the future?

IPv6 must be supported not only by the PSWBN, but by all network devices globally.

While a detailed discussion of the importance of IPv6 is beyond the information requested by the Commission, it should be noted that IPv4 exhaustion – that is, the point at which there are no more IPv4 addresses left to allocate – is predicted to occur by the end of 2012.⁸ IPv6 is the broader industry's means to prevent IP exhaustion. Eventually, all networks must either migrate to IPv6 or must present themselves as IPv6 devices through NAT translation⁹ to ensure the integrity of the global internet.

⁸ See Organisation for Economic Co-Operation and Development, March 2010. "Internet Addressing: Measuring Deployment of IPv6", p. 40.

⁹ See *Id.* at p. 5.

An IPv4 device cannot communicate directly with an IPv6 device, and can only do so by means of a gateway providing inter-version NAT.¹⁰

It is not uncommon for devices to support dual-stack mode (simultaneously supporting both IPv4 and IPv6).¹¹ However, while one device itself can operate on either an IPv4 or IPv6 network, it cannot operate on both simultaneously.

IPv6 is a public safety interoperability topic as well. Devices must use the same IP version to set up ad-hoc networks to operate in peer-to-peer mode. As all network devices should operate in IPv6 eventually, PSWBN devices should operate natively in IPv6 from the beginning so that they may support peer-to-peer communications as networks and devices mature.

Commission (¶ 36): In the Plan, a recommendation was also made to require certain broadband commercial carriers to accommodate roaming by public safety broadband users.

The State supports this recommendation. The Commission has established a precedent for requiring cellular network operators to transmit wireless data for emergency communications; for example, wireless service providers are required to transmit 911 calls regardless of whether the caller is a customer of that provider.¹² Similar rules could be imposed for PSWBN roaming. In the course of instituting such a requirement, network providers should have some mechanism to ensure cost recovery, as they generally do for the 911 services required of them.¹³

Commission (¶ 37): [We] tentatively conclude that within the context of public safety broadband networks, there would be significant efficiency gains if such functions were performed by third party clearing houses rather than by each network operator.

The State concurs. It is our understanding that cellular operators have used the clearing house approach for years in order to handle billing for roaming between operators domestically as well as abroad, and as a result, roaming is more or less transparent to the consumer. The same transparency would be beneficial to responders who may roam between coverage areas within and through the borders of the PSWBN.

Commission (¶ 38-41): The anticipated set of regional or tribal broadband networks will not serve as a nationwide interoperable broadband network unless they are interconnected with adequate capacity to support the end-to-end interoperable connections traversing multiple networks and to support roaming connections . . . Three alternatives are outlined here for

¹⁰ See *Id.*

¹¹ See *Id.* at p.40; E.g., Microsoft Vista and above fully support IPv6.

¹² See “FCC Consumer Facts: Emergency Communications.” “The FCC’s basic 911 rules require wireless service providers to transmit all 911 calls to a PSAP, regardless of whether the caller subscribes to the provider’s service or not.” <http://www.fcc.gov/cgb/consumerfacts/emergencies.html>

¹³ See, For Example, Minnesota Statutes §403.11 Subd. 3: “Any wireless or wire-line telecommunications service provider is eligible to receive payment for 911 services rendered according to the terms and conditions specified in . . . contract.”

consideration, and we seek comment on each . . . [1] Direct interconnectivity . . . [2] The public Internet . . . [3] Third party network operators . . . or tribal networks.

A fully-connected network is infeasible for the PSWBN; assuming that each state operates a PSWBN regional network, the overall network would require at least 1225 connections between different regional networks.¹⁴ Each connection would have to be sized sufficiently to handle broadband multimedia traffic. As the Commission notes, direct connection between entities with routine and significant roaming is appropriate, but direct connection between all network participants is not.¹⁵

The PSWBN will have to be connected to the public internet to access it, and thus through routers, firewalls, and other means establishing demarcation, part of it. However, the State does not feel that routing mission-critical traffic through the public internet is appropriate, and that no enterprise customer – public or private – would be comfortable doing so regardless of the security of data exchange afforded through VPN with AES or comparable isolation and security.

Many organizations – such as cellular and internet service providers – have had reason to develop the means to backhaul large amounts of data across networks and over large distances both securely and efficiently. Out of the three alternatives presented by the Commission, this pre-existing third-party backhaul may be the most cost-effective means to facilitate interconnection.

Commission (¶ 42): How should responsibility for such [roaming] interconnection be handled?

As with land mobile radio systems shared between government entities today, roaming should be handled through MOUs that clearly identify, in writing, the terms and limitations of roaming agreements as well as the agreements' sponsors and parties responsible.

Commission (¶ 43-46): We seek comment on how public safety broadband networks should support both prioritization and quality of service among connections as well as applications over these connections.

Priority with ruthless pre-emption is an essential element of the PSWBN. When surveyed and interviewed, Minnesota responders and communications managers consistently rate priority as a critical feature. This is particularly the case when presented with either a carrier-service or a public/private partnership model. Responders indicate that priority must be supported per user, per device, and per application.¹⁶

¹⁴ See FCC 11-6, pg. 14: "If the number of networks is 'n', the number of links connecting them would be——." Assuming, conservatively, that there are as many PSWBN regional networks as there are states in the US, there are 1225 such connections: ——.

¹⁵ See *Id.*: "While this solution can be implemented in certain situations where high volume of traffic between two regional broadband networks warrants the associated cost of dedicated links, we tentatively conclude that this solution is not scalable and hence, not cost-effective."

¹⁶ See *Minnesota Public Safety Broadband Data Network Requirements Study*. As of this writing, study results are pending publication. This study includes one-on-one interviews with network engineers, communications managers, and other

QoS is a fundamental requirement of any network carrying multimedia services, and so, it is a fundamental requirement of the PSWBN. This requirement is highlighted if network operators plan to decommission their land mobile radio networks in favor of push-to-talk VoLTE; highly reliable land mobile radio systems have become part and parcel of first response, and responders suitably expect that same service delivered over LTE to be just as reliable. The PSWBN should be able to deliver voice at the expense of all other traffic. This requirement is generally shared by Minnesota public safety officials.¹⁷

The state of Minnesota is particularly interested in public/private partnership and augmented-service models,¹⁸ depending on feasibility and legality of various approaches.¹⁹ To meet the State's needs under any potential partnership or service agreement, Priority and QoS are essential features; public safety functions should, naturally, have a higher network priority than most, if not all, other functions. Without guaranteed RAN access, guaranteed bandwidth and backhaul, Priority with ruthless pre-emption, and QoS, first responders cannot rely on a carrier-provided or shared network during an incident.

Commission (¶ 50): Do we need to set up support for a minimum speed (in mph) for mobility and seamless handover while within a regional or tribal network? Similarly, do we need to set up support for a minimum speed for mobility and seamless handover while crossing neighboring networks (roaming)?

Yes, and yes – the Commission should require a minimum supported speed for mobility and should require handover both intra-network and inter-network while roaming.

In general, emergency vehicles such as those used for enforcement, fire suppression, and emergency medical service must be able to use the network while traveling at high speeds while en route to or during the commission of a response. High speeds are particularly important in rural areas, where responders may have to travel large distances, at high speeds, in a short period of time, and so may travel through a large number of sectors.

Mutual aid agreements and subsequent response across jurisdictional boundaries are common, and it is also common for each involved jurisdiction to have its own discrete communications system.²⁰ Seamless handoff is essential for those responders who routinely operate across the borders of networks in such arrangements.

executives as well as a detailed survey with hundreds of responses from responder personnel on-the-ground. The response to ¶ 43-46 is informed by this study, which is ongoing and not yet published as of this writing.

¹⁷ See *Id.* Interviewees frequently used Minnesota's ARMER trunked radio system as a performance benchmark when asked about anticipated performance for a PSWBN. Also, unless the Minnesota PSWBN is held to the same standard, interviewees reported unwillingness to migrate mission-critical voice to it.

¹⁸ The public/private partnership model is as outlined in 47 C.F.R. § 90 and prior Commission documents. The augmented-service model is where the State uses commercial networks where they are available, and builds out its own RAN only where commercial carriers do not or where it needs capacity.

¹⁹ See FCC11-6, 47 C.F.R. § 90, and 47 U.S.C. § 337 in various places. As of this writing, sharing of public safety spectrum with non-public safety partners is not allowed, and there is no licensee for the public/private partnership the 700 MHz D Block is intended for. So, the public safety community is limited in its partnership options.

²⁰ For example, Cass County, ND and Clay County, MN, who share a single dispatch center across county and state lines (website: <http://www.rrrdc.com/>) and have mutual aid agreements in place for virtually all public safety functions, but have separate radio systems.

See FCC 11-6, ¶ 51: "The power of any [PSWBN] emission shall be attenuated outside the band below the transmitter power (P) by at least $43 + 10 \log (P)$ dB".

Commission (¶ 51-54): Most of the parties that commented on the OOB limit specified in the Waiver Order expressed support for it. We therefore tentatively conclude to adopt this limit for the nationwide public safety broadband network. Our analysis demonstrates that these parameters provide protection against harmful interference for the public safety broadband network and will further advance interoperability across the network. We seek comment on this tentative conclusion.

The State supports limitations on out-of-band emissions as proposed and has no specific recommendations for out-of-band emissions differing from those proposed by the Commission.

Commission (¶ 57-59): [We propose to require that] users of each network have access to [the] common set of applications . . . recommended in the NPSTC BBTF Report: (1) Internet access; (2) Virtual Private Network (VPN) access to any authorized site and to home networks; (3) a status or information “homepage;” (4) provision of network access for users under the Incident Command System; and (5) field-based server applications . . . in addition to the five applications specified in the Waiver Order, two other applications should be required to be supported by public safety broadband networks: the remaining two are (1) Status/Information “SMS-MMS Messaging” and (2) Land Mobile Radio (LMR) Gateway Devices. We seek comment on whether to require public safety networks to support these applications as well.

The State concurs with the original set of (5) required features and applications. The State does not feel it is appropriate to require additional features and applications at this time.

However, SMS messaging should not be considered a required or critical application for the PSWBN. It is not a service that suits public safety. SMS has the following shortcomings:

- SMS is best-effort (has no guaranteed delivery or verification)
- Transmissions are store-and-forward (may have delayed delivery, may be delivered in the wrong order, may be modified or may be discarded)
- SMS is location-unaware (has no means through which a message may be associated with the location of its sender, other than the device adding location within the message itself)
- SMS has low security; (has no protection against spoofing, denial of service, spam, etc)²¹

In general, the limitations affecting SMS for first responders are the same limitations affecting SMS for 911. As MMS is technologically similar to SMS, and incorporates SMS messages into its operation, it has, for this discussion, the same limitations.²²

Also specifically, it is inappropriate to require the support of Land Mobile Radio Gateway Devices unless there is a legitimate and demonstrated need to do so. For example, in areas where narrowband and broadband

²¹ See, *In General*: 4G Americas, “Texting to 9-1-1: Examining the Design and Limitations of SMS”, October 2010, pp. 5-7.

²² See *Id.*, p. 32.

networks are operate concurrently, it may be determined there is no immediate benefit to installing a gateway device unless it is to support interoperability with a separate entity under special conditions.

Commission (¶ 58): We seek comment on how to address the interconnection of existing narrowband public safety networks (both voice and data) in multiple bands (Legacy Networks).

As mentioned previously, gateway devices exist on the market for the conversion of voice traffic from one mode to another. As critical interfaces become more widely available in public safety narrowband networks – for example, P25 standards CSSI and ISSI – interconnection between public safety narrowband networks and the PSWBN should be straightforward and relatively feature-complete.

Regarding the interconnection of data between narrowband and broadband networks, a data-enabled P25 radio exchanges IP packets outside of the RAN, so in principal, there should be no issue.

Commission (¶ 59-62): We tentatively conclude that in order to ensure baseline operability and to ensure the efficient use of the radio frequency resource, it is appropriate to adopt performance requirements for public safety broadband networks. We seek comment on this tentative conclusion.

In general, it is not appropriate for the Commission to set network performance requirements for PSWBN regional networks. There is no one set of requirements to meet the diverse needs of all public safety users nationwide. This approach is inconsistent with the Commission’s precedent for management of public safety spectrum. For example, other than providing a specific level of spectral efficiency, the Commission does not set baselines for Land-Mobile Radio networks regarding coverage, site capacity, and available backhaul.²³

In-building coverage, for example, can be achieved through a variety of means, and not all of these means are easily accounted for in a high-level network design. A DAS will provide indoor coverage in urban skyscrapers and tall concrete buildings and may even be included in coverage mapping. Mobile vehicular relays, which may be the best means of achieving in-building coverage in rural areas, are not easily accounted for in a design or coverage prediction, as they are not fixed and may operate at any of various power levels.

Commission (¶ 70): [We] seek comment on whether we should require more or less than eight hours of back-up power to each eNodeB site within a public safety broadband network.

As stated earlier, in general, it is inappropriate for the Commission to specify such requirements.

To directly address the Commission’s inquiry: as a cultural rule, public safety organizations generally build resilient networks,²⁵ and should be free to determine the best means through which to harden their own

²³ See C.F.R. 47 §90.631 and 90.633. Public safety LMR networks are generally required to have at least 70 subscribers per channel allocated, and licensed stations must be placed into operation within one year of license grant. Otherwise, Commission rules generally do not specify exact LMR network design characters.

²⁵ For example, Minnesota’s ARMER network, among other things, uses diverse routing for microwave backhaul with overlapping coverage in P25 RAN and backup power to achieve a very high degree of resiliency. Specific technical details will not be shared in this filing.

regional networks to suit their own needs. A network may be made more resilient at many stages and through many means, such as through back-up power, overlapping coverage,²⁶ diverse routing, deployable assets, emergency roaming agreements, and others. A wireless network may include any or all of these approaches. To require one approach specifically, e.g. backup power, does not directly address the objective, which is to ensure network resiliency.

Commission (¶ 71-75): [We] tentatively conclude that we should impose coverage and performance requirements on the networks that will comprise the nationwide public safety broadband network.

As stated earlier, in general, it is inappropriate for the Commission to specify such requirements.

To directly address the Commission's inquiry: The state of Minnesota has historically used a geographic coverage benchmark for its statewide trunked radio system, ARMER. This benchmark is 95% of each county in the state of Minnesota, exclusive of areas of great scenic and natural beauty.²⁷ This benchmark is popular throughout the State and is a widely-cited critical success of the system. Furthermore, a similar benchmark is proposed by communications leaders in the state as a benchmark for the Minnesota PSWBN.²⁸ Were the Commission to institute a related requirement for the PSWBN, the Commission may consider 95% of each county served.

Commission (¶ 76-79): [We] tentatively conclude that we should require that, ninety days prior to deployment, a public safety broadband network operator must notify any adjacent or bordering jurisdiction of its plans for deployment . . . We also observe that public safety broadband networks should employ interference mitigation techniques that will avoid signal/spectral efficiency degradation issues within a region and between overlapping with adjacent regions. Should the Commission impose such requirements and what are the costs and benefits of such an approach?

Under the Commission's rules, it is generally unlawful for any wireless operation to introduce harmful interference onto wireless spectrum licensed to another or otherwise used for a legitimate sanctioned purpose.²⁹ This requirement is adequate, and adding the additional requirement for specific LTE interference mitigation features is not helpful. The interference mitigation capability built into LTE is a means to an end, where the goal is to mitigate interference, and not an end in itself.

The technical and procedural details of interference mitigation should be negotiated between licensees on a case-by-case basis. To that end, the Commission should require frequency coordination as it does for other wireless services. The Commission may consider utilizing the RPCs or may consider a similar organizational model.

²⁶ It is noted that with spectrum re-use of 1, the PSWBN cannot be engineered for simultaneous overlapping coverage in the traditional manner.

²⁷ For example, the Boundary Waters Canoe Area, which encompasses over 1 million acres of wilderness in northeastern Minnesota, is exempted from the 95% coverage requirement. In this region the State is working to provide coverage as comprehensively as is possible and responsible.

²⁸ See Minnesota Public Safety Broadband Data Network Requirements Study.

²⁹ See C.F.R. 47, various sections. Prohibition against "harmful interference" is written almost invariably as a general requirement for licensees, often without technical detail regarding the specific nature of such interference.

Commission (¶ 80-84): We tentatively conclude that each broadband operator must protect any potentially affected narrowband incumbent by technical measures or geographic separation, or must relocate the incumbent at its own expense . . . If so, what should be the basis of these technical rules (e.g., distance separation, contour overlap etc.)? . . . If so, what should be the basis of these technical rules (e.g., distance separation, contour overlap etc.)?

Broadband operators should be required to account for incumbent narrowband or wideband data protection as part of their deployment, and accordingly, frequency coordination should include concurrence from incumbent operators, such as who are licensed under the historical interleaved channel plan.

It is inequitable to shift the costs of relocation onto the shoulders of broadband operators. The Commission may look to revenue from proposed spectrum auction, intended for the construction and maintenance of broadband networks, to relocate incumbent operators.³⁰ The Commission is noted for expression its commitment to account for incumbent relocation.³¹

Regarding technical rules for proving incumbent protection, the Commission should defer to local operators, or to whichever organization is assigned responsibility for coordinating public safety broadband spectrum (again, the State proposes that the RPC model, or the RPCs themselves, are employed for this coordination). The Commission may consider requiring concurrence from incumbent operators in or adjacent to PSWBN implementations.

Commission (¶ 87): We propose to define a 700 MHz public safety roamer in our Part 90 rules as “A mobile station receiving service from a station or system in the public safety broadband network other than one to which it is a subscriber.” We seek comment on this tentative definition . . . We broadly divide intra-system public safety roamers into three categories based on the nature of their mission: “Itinerant roamers” . . . “Interoperability roamers” . . . [and] “Response roamers” . . .”

The State concurs with the Commission’s definition of “public safety roamer” as well as the proposed three categories of roamers. However, as the general consensus throughout the public safety community supports a single PLMN ID for the PSWBN, the Commission is reminded that “roaming” between PSWBN regional networks, in this case, is operational, and not technical. Roaming from a technical standpoint would occur only between the national PSWBN and commercial networks.

Commission (¶ 88): We tentatively conclude that the obligation to provide public safety roaming extends to all 700 MHz public safety broadband providers in order to ensure nationwide interoperability among public safety broadband networks . . . We seek comment on this tentative conclusion.

³⁰ See H.R. 607, 112th Congress, 1st Session, § 201-208. Among other funding mechanisms, this bill calls for the auction of wireless spectrum to, in part, fund the PSWBN.

³¹ See FCC 11-6, pg. 25: “ We remain committed to providing for the relocation of narrowband incumbents from the public safety broadband spectrum . . .”

The state of Minnesota concurs with this requirement.

Commission (¶ 94-99): [As] a threshold issue we ask whether public safety broadband network operators anticipate absorbing intra-system roaming costs generated by other public safety users as an operational cost or whether they expect to use roaming rates or charges to recover these costs . . . to the extent that action is necessary, we seek comment on what steps the Commission could take to facilitate reasonable rates for intra-system roaming.

It is unlikely that there is a single roaming and compensation model to fit the national PSWBN.

Whether costs are absorbed or not depends on the cost model afforded to the regional network owner. The State anticipates that some regional networks will be owned and operated exclusively by a public safety organization, others will be owned and operated by a carrier providing wireless service, and the rest will fall somewhere in-between. The State does not anticipate that the national PSWBN will be wholly-owned by public safety organizations as LMR systems generally are today, but does anticipate that a small number of regional networks will be.

For a regional network under the independently owned-and-operated model, it may be easy to absorb roaming costs internally, as the actual incurred incremental expense of periodic roaming will probably be minimal. On the other hand, for a regional network under the carrier service model, the incremental cost of a roamer may equate to that of a full subscriber. Until pricing models for carrier-operated networks are available, it is difficult to comment on this issue. In either case, it is likely that different public safety organizations will absorb roaming costs for interoperability partners in the spirit of mutual aid.

As such, roaming agreements should be coordinated between local operators. The Commission may consider the requirement to include a roaming agreement with adjacent operators in frequency coordination, and may also consider encouraging regional network operators to absorb roaming costs for the purposes of seamless mutual aid.

Commission (¶ 100-105): We [determine] to retain the existing rule that allows Federal use of this spectrum . . . we believe it is worthwhile to re-examine this rule to ensure that it is consistent with the current approach to ensuring nationwide interoperability. We also note that the current rule could arguably be construed to allow direct leasing of spectrum for Federal use (e.g., “Federal stations may be authorized...”), as opposed to merely allowing Federal users access to the network as subscribers.

The State feels that Federal users should be afforded full use of the PSWBN, and that the Commission should act to the fullest extent legally practicable to ensure that Federal users can do so.

One of the most significant routine barriers to public safety interoperability is the lack of a single frequency band for all of public safety and the lack of a single technology standard for public safety wireless voice systems.³²

³² While the public safety community overwhelmingly supports Project 25, not all public safety organizations use it. Even within the state of Minnesota, in which the ARMER radio network will cover the entire state with a 7/800 MHz Project 25

While gateway devices, multi-band radio equipment, and other technology solutions can bridge these gaps, the solutions are inelegant, usually expensive, and require extensive pre-planning. All three of these shortcomings are contrary to the fundamental principle of interoperability. Were all public safety users – state, federal, local, and others – on the same frequency band and using the same wireless air interface standard, this barrier to interoperability may be completely eliminated.

The State envisions a mid-term future where all public safety users are operating on a single, interconnected, wireless broadband network: the nationwide PSWBN. This outlook is shared by the Commission, the public safety community at large, and in part, the Federal legislature.³³ To that end, all public safety users, no matter whom they are and who they work for, should be provided access to the PSWBN.

Commission (¶ 106-116): We . . . tentatively conclude that we should require that all user devices be subject to conformance testing and seek comment on this tentative conclusion. We . . . tentatively conclude that we should require that all user devices be subject to conformance testing and seek comment on this tentative conclusion . . . Should the commission adopt IOT rules to ensure multi-vendor interoperability on public safety broadband networks?

Yes, the Commission should require conformance testing and interoperability testing.

Commission (¶ 118): We . . . seek comment on whether to impose on public safety network operators a periodic reporting requirement similar to that imposed on waiver recipients.

Yes, the Commission should have reporting requirements for PSWBN regional networks.

It is noted that the Commission has established a precedent for build-out targets for other radio services.³⁴ A similar, but not identical approach should be used for the PSWBN. For public safety Private Land Mobile Radio Services, the general requirement is to have licensed stations placed into operation within 12 months of a license grant.³⁵ 12 months is an appropriate timeframe for an individual station, but is not so for large statewide wireless networks with hundreds of sites, which are constructed on the order of one decade or more rather than one year.³⁶

RAN, various local entities have found it expedient to operate independent land mobile radio systems and/or to operate in different frequency bands. State and local government collectively oversee significant implementations of 7/800 MHz P25 trunked, VHF analog conventional, and VHF P25 conventional radio systems.

³³ See, For Example, H.R. 607, 112th Congress, 1st Session, § 207(a). This bill calls for public safety entities to end their operations between 420 and 512 MHz and for Federal law enforcement entities to migrate all non-commercial communications to the 700 and 800 MHz bands. Note: this citation does not imply endorsement of this bill.

³⁴ See C.F.R. §90.155(a): “All stations authorized under this part . . . must be placed in operation within twelve (12) months from the date of grant or the authorization cancels automatically and must be returned to the Commission.

³⁵ See *Id.*

³⁶ See, For Example, ARMER Project Plan, Exhibit 3: Time Line. The plan to extend the Twin Cities Metropolitan Trunked Radio system throughout the entire state of Minnesota was originally estimated to begin in Q2 2004 and to end in Q3 2012. Note that at this time, a sizeable portion of the ARMER network – the densely populated Twin Cities area – was already in

Given the nature of such projects, the Commission may consider a maximum build-out target of one decade. Regarding specific licenses, the Commission should review specific reporting requirements on a case-by-case basis, as the requirements for specific regional networks will vary substantially. For example, some buildouts may prioritize the rural areas of a state, and so a geographic benchmark may be best, but other buildouts may be restricted to urban centers, and so a sites-to-population density benchmark ratio may be best.

It will not be burdensome for the Commission to track individualized reporting. There will not likely be more than 102 PSWBN licensees.³⁷

Commission (¶ 119-122): In order to facilitate the development of interoperable public safety LTE networks, we seek comment below on the use of LTE devices on [public safety wireless broadband] networks . . . [1] Channel Bandwidth Requirement for the Public Safety Broadband Spectrum . . . [2] Band Class 14 Support . . . [3] Multiple Mode Support[.]

Public safety devices operating in public safety spectrum should support 5 and 10 MHz per-channel bandwidths in that spectrum. Either through allocation or through public/private partnership, it is reasonable to assume that Public Safety devices will operate over the entirety of LTE Band Class 14, but may in various regions operate only on the 5x5 MHz public safety allocation or across the entire 10x10 MHz band class.

Public safety devices are anticipated to operate on networks operated by carriers, who may at some point utilize channel bandwidths up to 100 MHz through carrier aggregation.³⁸ Public safety devices should be able to support spectrum configurations as necessary to support the full capability to operate on commercial spectrum as consumer devices will. To do so, public safety devices will need to support many band classes in various combinations.

It will be convenient for public safety if PSWBN devices support both HSPA and EVDO platforms simultaneously, as major wireless carriers who are prominently advertising current LTE deployments in Minnesota³⁹ each use one of the two different platforms.^{40 41} The State's understanding is that manufacturers are designing LTE chipsets that support LTE and *either* HSPA *or* EVDO. The State does not prefer either HSPA or EVDO over the other, but does prefer that public safety LTE devices, whichever 3G platform they support, use the same 3G platform(s) as a comprehensive industry standard.

operation. It is therefore reasonable to assume that a statewide wireless network like ARMER could be built by a state government over the course of one decade.

³⁷ See "Estimates of the Population of Metropolitan and Micropolitan Statistical Areas" prepared annually by the United States Census Bureau. As of this writing, there are approximately 52 metropolitan statistical areas with an estimated population of over 1 million and 50 states in the US. It is unlikely a metropolitan area with a population of under 1 million people will have the resources to implement its own regional PSWBN, and at most each state will have its own PSWBN, and so, a relatively unscientific estimate predicts there will be no more than 102 PSWBN licensees.

³⁸ See 3GPP TR 36.912 V 10.0.0.: "LTE-Advanced extends LTE release 8 with support for Carrier Aggregation, where two or more component carriers (CC) are aggregated in order to support wider transmission bandwidths up to 100MHz and for spectrum aggregation."

³⁹ As of this writing, AT&T and Verizon.

⁴⁰ See Verizon Wireless, "Mobile Broadband" <https://www.verizonwireless.com/b2c/mobilebroadband/?page=coverage>. Verizon's 3G network uses EVDO technology, which is incompatible with HSPA chipsets.

⁴¹ See AT&T, "UMTS/HSPA 3G Mobile Broadband" <http://www.wireless.att.com/learn/why/technology/3g-umts.jsp>. AT&T's 3G network uses HSPA technology, which is incompatible with EVDO chipsets.

Commission (¶ 123-126): [We] tentatively conclude that we should adopt a framework to achieve in-building coverage.

No, the Commission should not adopt a framework to achieve in-building coverage. Network operators should assess their users' needs and react accordingly. For example, it may not be feasible to build DAS or RF sites to accommodate every rural building in Minnesota that has coverage issues, but vehicular mobile relays, Wi-Fi bridges, or other novel solutions may adequately extend coverage to meet this requirement without extending the core PSWBN as would be shown on a coverage map.

Commission (¶ 129): [We] tentatively conclude that we should allow public safety to operate fixed services in this band on an ancillary basis. We seek comment on this tentative conclusion.

No, there should be no such limitation.

If fixed stations are provided secondary access status, public safety organizations cannot feasibly explore partnerships with organizations currently excluded from the Commission's authorized users of this spectrum, such as municipalities, transit authorities, and public utilities. Utilities, in particular, have expressed as a community the desire to build a reliable, low-cost smart grid using a public safety LTE RAN. This concern has been expressed by public safety organizations and utility operators alike in many avenues.

If public safety network operators are to decommission land-mobile radio systems in favor of converged broadband data networks, operators will deploy fixed stations. For example, this migration would require some analog for a radio control station. The most elegant technology solution for this problem is a fully-interconnected fixed station with no RF elements, such as the interconnected dispatch consoles used in trunked land mobile radio networks today. However, land mobile radio network operators find situations in which a control station is more practical than an interconnected station,⁴² and it stands to reason that operators will find similar reasons to deploy fixed LTE subscriber stations.

The State envisions many partnerships as a potential means through which regional PSWBN networks may be feasible. Many such partnerships, including the aforementioned municipal and utility partners, would require the primary licensing of fixed stations. Examples inside and outside of public safety include the provision of internet access to rural areas, the aforementioned utility smart grid, backup WAN access to PSAPs, backup and/or primary WAN access for NG911 purposes, government WAN backup diversity, and others. Such partnerships may justify the implementation of PSWBN regional networks that are infeasible otherwise and may also support the funding and construction of such networks where otherwise funding is insufficient or unavailable.

Fixed devices in the PSWBN a network should not be licensed or treated any differently than mobile devices. Considering a spectrum reuse of 1, a fixed device does not function, in theory, any differently from a mobile device that happens to be stationary at the time it is operating.

⁴² See Minnesota Public Safety Interoperable Communication PSAP and EOC Radio Control Stations project.

Finally, it is not helpful to distinguish between a "primary" and a "secondary" user of an LTE network under the Commission's historical definition of such users.⁴³ The Commission's rules restrict the secondary user on the basis of whether the secondary user produces harmful interference to the primary user. However, in a shared LTE network, the secondary user produces *congestion*, not *interference*. Problems of congestion may be solved, in theory, by network management practices such as priority, QoS, and remote stun/kill.

Commission (¶ 133): We seek comment on the how best to ensure that the public safety broadband network can interconnect with NG911 networks to support such communication. Are there technical issues that need to be addressed?

The two networks should not be considered as separate and distinct. NG911 networks are all-IP,⁴⁴ as the PSWBN is envisioned to be. Aside from routine enterprise IT and internal policy issues, there should be no significant technical barriers to integration.

Commission (¶ 134-140): [We seek comment on] each of [Telecommunication Act] Section 337(f)(1)(A)'s requirements . . .

The Commission has no legal authority to change the definition of eligible users for the 700 MHz public safety band.⁴⁵ However, the Commission is encouraged to work to the fullest extent legally practicable to broaden that definition to include all government users, as well as government and non-government partners who share a common interest in the public good. Such partners may include, but may not necessarily be limited to: utilities, transit authorities, municipalities, and various state and Federal government agencies.

The definition of a public safety user in 47 U.S.C. § 337(f) is a departure from precedent. The Commission should also consider that eligible users of Public Safety Pool frequencies generally include any government activity, disabled and legally blind individuals, veterinarians, disaster relief organizations, schools, and others.⁴⁶ Many Public Safety Pool eligibles are not allowed to use 700 MHz public safety spectrum, as their primary purpose is not the protection of life, health, or property, even though these same users are generally allowed access to other public safety frequencies.

Partnerships with non-public safety or non-government entities are critical to the success of the PSWBN. For example, the Minnesota ARMER radio system is employed not only for public safety officials, but for diverse government and pseudo-government organizations that share a common public interest in public safety. The regional PSWBN in Minnesota would similarly be expected to be employed not just as a public safety network for enforcement, EMS, and fire suppression, but as a government communications network in general, much like the ARMER system.

⁴³ See C.F.R. 47 §2.104. The Commission's definition of a "secondary user" is one who is not allowed to cause harmful interference to a primary user, and who cannot claim protection from interference from a primary user, but can claim protection from a co-secondary user.

⁴⁴ See NENA NG9-1-1 Project. <http://www.nena.org/ng911-project>

⁴⁵ 47 U.S.C. § 337(f). This statute defines an eligible entity as having "the sole or principal purpose . . . to protect the safety of life, health, or property".

⁴⁶ See C.F.R. 47 §90.20.

Preliminary estimates for a regional PSWBN implementation in Minnesota would require approximately 1000 sites.⁴⁷ The state of Minnesota and local units of government will have collectively built 328 RF sites for the ARMER system by the end of 2012,⁴⁸ but the State will need over 650 additional sites for a regional PSWBN. Without partners outside of public safety whose “sole or principal purpose” deviates from U.S.C. Title 47’s definition, it will be difficult – or impossible – to justify or control the expense of building such a network in Minnesota.

While the State applauds efforts to provide Federal funding to build a nationwide PSWBN, it is not likely that there will be adequate Federal funding to build the *tens of thousands* of dedicated public safety wireless sites that would be required for a nationwide LTE network.⁴⁹ Without partnerships, the nationwide PSWBN will have the same feasibility footprint of commercial networks, and such, will provide little incentive for public safety organizations to build out the PSWBN in favor of continuing to use commercial service.

The narrow definition of eligible users has a negative impact on overall interoperability, as well. For example, many government agencies whose principal purpose deviates from core public safety functions are included in tactical incident communication plans and incident staging/pre-planning drills. These users are generally eligible to operate on LMR networks under MOU, and so can seamlessly interoperate with public safety users. If such users are not to operate on the PSWBN, they cannot seamlessly interoperate once all core public safety communications will have, invariably, migrated to a converged data network.

(end)

⁴⁷ See State of Minnesota Public Safety Wireless Broadband Data Network Requirements Study.

⁴⁸ See State of Minnesota, “Current and Projected Sites on the Air”,
<http://www.srb.state.mn.us/ArmerDispArt.asp?aid=411>.

⁴⁹ See, For Example, Joseph Palenchar, TWICE, February 2011: “GPS Industry Worries About Lightsquared Interference”,
http://www.twice.com/article/464387-GPS_Industry_Worries_About_Lightsquared_Interference.php. Consumer media reports that LightSquared plans to build 40,000 sites in order to cover the entire United States with 4G service using the LTE platform.